

CALIFORNIA STRUCTURAL ENGINEERING SEISMIC EXAMINATION OUTLINE

I. Development of Seismic Design Criteria

Selection of design criteria, investigation of site conditions, and selection of structural systems.		
Job Tasks		Associated Knowledges
<i>T1</i>	Evaluate applicability of building codes/guidelines.	<i>K01</i> K of lateral force requirements for elements of structures, non-structural components, equipment anchorage and non-building structures. <i>K03</i> K of procedures to determine design requirements for structures with structural irregularities.
<i>T2</i>	Evaluate geohazard, and geotechnical and site-specific seismic criteria (e.g., seismic maps, geotechnical investigation).	<i>K04</i> K of effects of site geology and soil characteristics. <i>K05</i> K of acceptance criteria for various performance objectives considering serviceability, strength and collapse prevention. <i>K06</i> K of basic seismology and vibration theory.
<i>T3</i>	Select structural systems based on various factors (e.g., seismic criteria, cost, architectural constraints, performance objectives).	<i>K07</i> K of lateral-force-resisting systems. <i>K08</i> K of code prescribed limitations on story drift, building separations, and deformation compatibility. <i>K09</i> K of nonlinear behavior of lateral-force-resisting systems. <i>K11</i> K of performance of structural systems. <i>K15</i> K of response of structures to seismic loads. <i>K28</i> K of analysis of foundation systems.
<i>T4</i>	Determine structural performance objectives (e.g., serviceability, strength, collapse prevention, life safety, immediate occupancy, continuous operation).	<i>K36</i> K of design for: diaphragms. <i>K37</i> K of design for: Specific lateral-force-resisting systems. <i>K50</i> K of base isolated structures. <i>K51</i> K of passive energy dissipation devices. <i>K53</i> K of anchorage of nonstructural building elements including equipment anchorage. <i>K56</i> K of design for properties of building materials.
<i>T5</i>	Determine special design requirements (e.g., vertical and horizontal irregularities, torsion, directional effects).	<i>K66</i> K of investigation and evaluation procedures using applicable guidelines. <i>K67</i> K of failure mechanisms for different types of structural elements and/or connections in existing structures. <i>K68</i> K of yield mechanism for different types of structural elements and/or connections in existing structures. <i>K69</i> K of foundation systems in existing structures. <i>K70</i> K of historical design procedures and codes for assessing existing structures. <i>K71</i> K of performance of structural systems of existing structures. <i>K84</i> K of mitigation options for structural strengthening based on applicable codes, guidelines and/or life-safety criteria. <i>K85</i> K of remedial measures to repair structural and nonstructural damage, deterioration, and defects of existing structural members and connections. <i>K86</i> K of preparation of structural specifications for strengthening of existing structures. <i>K87</i> K of structural testing, inspection and observation for strengthening of existing structures.

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CALIFORNIA STRUCTURAL ENGINEERING SEISMIC EXAMINATION OUTLINE

II. Seismic Analysis of New and Existing Structures

Determination of type, magnitude and combinations of loads that act on new, existing and non-building structures; determination of external and internal forces and deformations generated by loads.		
Job Tasks		Associated Knowledges
<i>T6</i>	Determine the seismic load path (e.g., vertical and lateral force-resisting elements, diaphragms, drag struts, connections, foundation).	<i>K01</i> K of lateral force requirements for elements of structures, non-structural components, equipment anchorage and non-building structures. <i>K03</i> K of procedures to determine design requirements for structures with structural irregularities. <i>K04</i> K of effects of site geology and soil characteristics. <i>K05</i> K of acceptance criteria for various performance objectives considering serviceability, strength and collapse prevention.
<i>T7</i>	Determine applicable load combinations.	<i>K06</i> K of basic seismology and vibration theory.
<i>T8</i>	Construct and use free-body diagrams.	<i>K07</i> K of lateral-force-resisting systems.
<i>T9</i>	Determine structural modeling and characteristics of the structure (e.g., stiffness, mass, damping, boundary conditions).	<i>K08</i> K of code prescribed limitations on story drift, building separations, and deformation compatibility.
<i>T10</i>	Calculate seismic forces for structures:--by static force procedures.	<i>K09</i> K of nonlinear behavior of lateral-force-resisting systems.
<i>T11</i>	Calculate seismic forces for structures:--by dynamic analysis procedures.	<i>K10</i> K of lateral pressures on earth retaining structures due to seismic ground shaking.
<i>T12</i>	Analyze structural systems to determine:--forces in members and connections, deformation, and stability (e.g., moment frames, braced frames, shear walls).	<i>K11</i> K of performance of structural systems.
<i>T13</i>	Analyze structural systems to determine:--building drift including horizontal torsion.	<i>K12</i> K of diaphragm rigidity and deflection.
		<i>K13</i> K of material standards.
		<i>K15</i> K of response of structures to seismic loads.
		<i>K17</i> K of dynamic analysis procedures to determine seismic forces.
		<i>K18</i> K of static force procedures to determine seismic forces.
		<i>K19</i> K of calculating seismic design base shear.
		<i>K20</i> K of calculating vertical distribution of seismic forces.
		<i>K21</i> K of calculating horizontal distribution of seismic forces.
		<i>K22</i> K of calculating overturning moment and stability of the structure.
		<i>K23</i> K of modeling techniques for computerized structural analysis programs.
		<i>K24</i> K of interpretation of results from computerized structural analysis programs.
		<i>K25</i> K of effects of structural irregularities and structural discontinuities.
		<i>K26</i> K of analysis of diaphragms assumed to be flexible.
		<i>K27</i> K of analysis of diaphragms assumed to be rigid.
		<i>K28</i> K of analysis of foundation systems.
		<i>K29</i> K of analysis of lateral pressures on earth retaining structures due to seismic ground shaking.
		<i>K30</i> K of analysis of frame structures.
		<i>K31</i> K of analysis of shear wall structures.
		<i>K32</i> K of calculation of story drifts.

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II. Seismic Analysis of New and Existing Structures Cont.

Determination of type, magnitude and combinations of loads that act on new, existing and non-building structures; determination of external and internal forces and deformations generated by loads.

Job Tasks	Associated Knowledges
<p><i>T14</i> Analyze structural systems to determine:-- forces in horizontal diaphragm elements (e.g., drag struts, chords, at discontinuities).</p>	<p><i>K33</i> K of analysis of statically indeterminate structures using—manual calculations. <i>K34</i> K of analysis of statically indeterminate structures using—computer programs. <i>K66</i> K of investigation and evaluation procedures using applicable guidelines. <i>K67</i> K of failure mechanisms for different types of structural elements and/or connections in existing structures.</p>
<p><i>T15</i> Analyze structural systems to determine:-- forces in vertical and lateral force-resisting elements (e.g., at discontinuities, boundary elements, braces, uplift).</p>	<p><i>K68</i> K of yield mechanism for different types of structural elements and/or connections in existing structures. <i>K69</i> K of foundation systems in existing structures.</p>
<p><i>T16</i> Perform dynamic linear analysis to determine structural characteristics and response.</p>	
<p><i>T17</i> Determine deformation compatibility of elements not part of the lateral-force-resisting system.</p>	
<p><i>T18</i> Determine seismic forces on elements of structures, nonstructural components and equipment.</p>	

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CALIFORNIA STRUCTURAL ENGINEERING SEISMIC EXAMINATION OUTLINE

III. Seismic Design and Detailing of Structures

Design of elements and connections for new, existing and non-building structures using a variety of materials such as steel, concrete, wood and masonry including recommendations for seismic repair and/or strengthening.

Job Tasks	Associated Knowledges
<p>T19 Determine design requirements for all structural elements in the seismic load path (e.g., vertical and lateral force-resisting elements, diaphragms, drag struts, connections, foundation) and recommendations for seismic repair and/or strengthening.</p>	<p>K01 K of lateral force requirements for elements of structures, non-structural components, equipment anchorage and non-building structures. K03 K of procedures to determine design requirements for structures with structural irregularities. K04 K of effects of site geology and soil characteristics. K05 K of acceptance criteria for various performance objectives considering serviceability, strength and collapse prevention. K06 K of basic seismology and vibration theory. K07 K of lateral-force-resisting systems. K08 K of code prescribed limitations on story drift, building separations, and deformation compatibility.</p>
<p>T20 Determine detailed systems design requirements (e.g., detailing for combinations of systems, deformation compatibility, adjoining rigid elements, ties and continuity, building separations).</p>	<p>K09 K of nonlinear behavior of lateral-force-resisting systems. K10 K of lateral pressures on earth retaining structures due to seismic ground shaking. K11 K of performance of structural systems. K12 K of diaphragm rigidity and deflection. K13 K of material standards. K15 K of response of structures to seismic loads.</p>
<p>T21 Determine appropriate:--seismic provisions for lateral force resisting systems and elements based on the material types.</p>	<p>K17 K of dynamic analysis procedures to determine seismic forces. K18 K of static force procedures to determine seismic forces. K19 K of calculating seismic design base shear. K21 K of calculating horizontal distribution of seismic forces.</p>
<p>T22 Determine appropriate:--seismic provisions for foundations.</p>	<p>K22 K of calculating overturning moment and stability of the structure. K23 K of modeling techniques for computerized structural analysis programs. K24 K of interpretation of results from computerized structural analysis programs. K25 K of effects of structural irregularities and structural discontinuities.</p>
<p>T23 Determine appropriate:--seismic provisions for elements that are not part of the lateral force-resisting systems.</p>	<p>K26 K of analysis of diaphragms assumed to be flexible. K27 K of analysis of diaphragms assumed to be rigid. K28 K of analysis of foundation systems. K29 K of analysis of lateral pressures on earth retaining structures due to seismic ground shaking.</p>
<p>T24 Design and detailing of:--members of vertical and horizontal lateral force resisting systems.</p>	<p>K30 K of analysis of frame structures. K31 K of analysis of shear wall structures. K32 K of calculation of story drifts.</p>

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**CALIFORNIA STRUCTURAL ENGINEERING
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III. Seismic Design and Detailing of Structures Cont.

Design of elements and connections for new, existing and non-building structures using a variety of materials such as steel, concrete, wood and masonry including recommendations for seismic repair and/or strengthening.

Job Tasks	Associated Knowledges
<p>T25 Design and detailing of:--connections of vertical and horizontal lateral force resisting systems.</p>	<p><i>K33</i> K of analysis of statically indeterminate structures using—manual calculations. <i>K34</i> K of analysis of statically indeterminate structures using—computer programs. <i>K36</i> K of design for: diaphragms. <i>K37</i> K of design for: Specific lateral-force-resisting systems. <i>K50</i> K of base isolated structures.</p>
<p>T26 Design and detailing of:--horizontal diaphragms and bracing systems, drag struts, chords and details of splices and connections.</p>	<p><i>K51</i> K of passive energy dissipation devices. <i>K53</i> K of anchorage of nonstructural building elements including equipment anchorage. <i>K56</i> K of design for properties of building materials. <i>K63</i> K of preparation of structural specifications. <i>K64</i> K of structural testing, inspection and observation.</p>
<p>T27 Design and detailing of:--connections between elements in the seismic load path.</p>	<p><i>K66</i> K of investigation and evaluation procedures using applicable guidelines. <i>K67</i> K of failure mechanisms for different types of structural elements and/or connections in existing structures.</p>
<p>T28 Design and detailing of:--foundations for seismic forces.</p>	<p><i>K68</i> K of yield mechanism for different types of structural elements and/or connections in existing structures. <i>K69</i> K of foundation systems in existing structures.</p>
<p>T29 Design and detailing of:--elements and connections of structures, nonstructural components and equipment anchorage.</p>	<p><i>K70</i> K of historical design procedures and codes for assessing existing structures. <i>K71</i> K of performance of structural systems of existing structures. <i>K72</i> K of post-earthquake safety evaluation of structural system for intended occupancy (e.g. damage or distress, excessive deformation). <i>K73</i> K of structural systems in existing structures.</p>
<p>T30 Design and detailing of:--non-building structures.</p>	<p><i>K80</i> K of anchorage of nonstructural building elements including equipment anchorage in existing structures.</p>
<p>T31 Design and detailing of:--connections between cladding elements and structural members.</p>	<p><i>K84</i> K of mitigation options for structural strengthening based on applicable codes, guidelines and/or life-safety criteria. <i>K85</i> K of remedial measures to repair structural and nonstructural damage, deterioration, and defects of existing structural members and connections. <i>K86</i> K of preparation of structural specifications for strengthening of existing structures. <i>K87</i> K of structural testing, inspection and observation for strengthening of existing structures. <i>K88</i> K of properties of building materials in existing structures.</p>
<p>T32 Examine potential retrofit options for compliance with applicable design criteria and/or budgetary or architectural constraints.</p>	

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III. Seismic Design and Detailing of Structures Cont.

Design of elements and connections for new, existing and non-building structures using a variety of materials such as steel, concrete, wood and masonry including recommendations for seismic repair and/or strengthening.	
Job Tasks	Associated Knowledges
T33 Design for compliance with applicable criteria to:--meet strength and stiffness requirements.	
T34 Design for compliance with applicable criteria to:--increase ductility.	
T35 Design for compliance with applicable criteria to:--mitigate irregularities and discontinuities.	
T36 Design for compliance with applicable criteria to:--increase local and global stability.	
T37 Design for compliance with applicable criteria to:--repair damage and/or deterioration (e.g., shear walls, connections).	
T38 Design for compliance with applicable criteria to:--strengthen connections.	
T39 Develop feasible options and constructible details considering the existing conditions of the structure.	
T40 Upgrade existing structure to meet current code requirements or the applicable level of compliance.	

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CALIFORNIA STRUCTURAL ENGINEERING SEISMIC EXAMINATION OUTLINE

IV. Seismic Review of Existing Structures

Evaluation of the structure to determine seismic deficiencies based on applicable design criteria and recommendations for seismic repair and/or strengthening.	
Job Tasks	Associated Knowledges
<i>T41</i> Review available construction documents.	<i>K01</i> K of lateral force requirements for elements of structures, non-structural components, equipment anchorage and non-building structures.
<i>T42/43</i> Conduct field observations, investigate, and document existing conditions by field observation and measurement.	<i>K03</i> K of procedures to determine design requirements for structures with structural irregularities. <i>K04</i> K of effects of site geology and soil characteristics. <i>K05</i> K of acceptance criteria for various performance objectives considering serviceability, strength and collapse prevention.
<i>T44</i> Review, request, or specify test(s) for material strengths and properties [e.g., tension, compression, shear test(s)].	<i>K06</i> K of basic seismology and vibration theory. <i>K07</i> K of lateral-force-resisting systems. <i>K08</i> K of code prescribed limitations on story drift, building separations, and deformation compatibility.
<i>T45</i> Evaluate the structure to determine seismic deficiencies and/or to determine non-compliance with applicable design criteria (e.g., vertical and horizontal lateral force resisting systems and elements, seismic load path, connections).	<i>K09</i> K of nonlinear behavior of lateral-force-resisting systems. <i>K11</i> K of performance of structural systems. <i>K13</i> K of material standards. <i>K15</i> K of response of structures to seismic loads. <i>K28</i> K of analysis of foundation systems. <i>K53</i> K of anchorage of nonstructural building elements including equipment anchorage. <i>K56</i> K of design for properties of building materials. <i>K63</i> K of preparation of structural specifications. <i>K64</i> K of structural testing, inspection and observation. <i>K66</i> K of investigation and evaluation procedures using applicable guidelines. <i>K67</i> K of failure mechanisms for different types of structural elements and/or connections in existing structures.
<i>T46</i> Determine seismic hazard mitigation requirements.	<i>K68</i> K of yield mechanism for different types of structural elements and/or connections in existing structures. <i>K69</i> K of foundation systems in existing structures. <i>K70</i> K of historical design procedures and codes for assessing existing structures. <i>K72</i> K of post-earthquake safety evaluation of structural system for intended occupancy (e.g. damage or distress, excessive deformation). <i>K73</i> K of structural systems in existing structures. <i>K80</i> K of anchorage of nonstructural building elements including equipment anchorage in existing structures. <i>K86</i> K of preparation of structural specifications for strengthening of existing structures. <i>K87</i> K of structural testing, inspection and observation for strengthening of existing structures. <i>K88</i> K of properties of building materials in existing structures.

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